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The shallow-water Polyplacophora of the Azores and some comments on the biogeographical relationships of the Azorean malacofauna

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KEY WORDS: Polyplacophora, Azores, biogeographical relationships.

ABSTRACT The Mollusc's reference collection of the Department of Biology of the University of the Azores (DBUA) was checked for Polyplacophora. A taxonomic list is given and new data is provided regarding the geographic distribution and bathymetric range of the Azorean Polyplacophora. Some comments are made about the biogeographical relationships of Gastropoda, Bivalvia, Cephalopoda and Polyplacophora of the Azores.

RIASSUNTO E' stata analizzata la collezione malacologica di riferimento del Dipartimento di Biologia dell'Università delle Azzorre (DBUA), considerando i soli Poliplacofori. Viene presentata una lista e nuovi dati riguardanti la distribuzione geografica ed il range batimetrico dei Poliplacofori ed alcuni aspetti delle relazioni biogeografiche di Gasteropodi, Bivalvi, Cefalopodi e Poliplacofori.

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INTRODUCTION

Among the few works that have been published about the shallow-water Polyplacophora of the Azores during the last century, the majority dealt with the systematics and distribution of this group (DAUTZENBERG, 1889; 1927; KAAS & VAN BELLE, 1981; 1985a; 1985b; MAC ANDREW, 1856; MACEDO *et al.*, 1999; NOBRE, 1924; VAN BELLE, 1984). Only in the last decade the ecology of this class has been studied (AZEVEDO, 1991; BULLOCK, 1995; HAWKINS *et al.*, 1990; MORTON *et al.*, 1998).

It is our intention to provide new data about the geographic distribution and bathymetric range within the Azores of the species of this class and to establish the biogeographical relationships of the marine malacofauna of the Azores.

MATERIALS AND METHODS

Polyplacophora from the Mollusc's reference collection of the Department of Biology of the University of the Azores (DBUA) were studied. The Polyplacophora in this collection were sampled between 1989 and 1999 by diving at depths up to 45 m. Dives were made by the Marine Biology team of the University of the Azores at Pico, Faial, Flores, São Miguel and Formigas islets.

A literature review was made and information included in the taxonomic list presented.

Species were identified using KAAS & VAN BELLE (1985a; 1985b; 1987; 1990; 1994) and the classification follows the CLEMAM database. All specimens were measured to the nearest mm. Dorsal elevation is the ratio height of tegmentum/width (see KAAS & VAN BELLE, 1985a).

RESULTS

A total of 801 samples of the DBUA collection were studied, of which 53 yielded Polyplacophora.

Of the six species of Polyplacophora reported from the Azores, *Acanthochitona discrepans* is considered to be a dubious record and three species were confirmed by us: *Hanleya hanleyi*, *Lepidochitona simrothi* and *Acanthochitona fascicularis*. The most common Polyplacophora in the Azores are *A. fascicularis* and the endemic species *L. simrothi*, appearing in 52 out of the 53 reported samples. The Azorean Polyplacophora have higher similarities with the Canary Islands, Boreal Province (Scandinavia and British isles) and the Lusitanian Province (mainland of Portugal) than with the Madeira or the eastern coast of north America (see Table 1).

TAXONOMIC LIST

Phylum MOLLUSCA
Class POLYPLACOPHORA
Order LEPIDOPLEURIDA
Family Hanleyidae

Hanleya hanleyi **(Bean in Thorpe, 1844)**

Hanleya hanleyi (Bean in Thorpe, 1844). Azores (KAAS & VAN BELLE, 1985a: 193-196).

Material examined: DBUA 551 (Porto da Baleia, Flores).

Bathymetry: from 15 down to 555m depth (KAAS & VAN BELLE, 1985a).

Dimensions: length = 7 mm; breadth = 4 mm; dorsal elevation = 0.3.

Table 1: Geographic distribution of the Azorean Polyplacophora. AZO – Azores; MAD – Madeira archipelago; CAN – Canary Islands; BRI – British isles; POR – mainland of Portugal; MED – western Mediterranean; SCA – Scandinavia; AME – eastern coast of north America. 1- presence, 0 – absence.

	AZO	MAD	CAN	BRI	POR	MED	SCA	AME
Hanleya hanleyi	1	1	1	1	1	1	1	1
Callochiton septemvalvis	1	0	1	1	1	1	1	0
Lepidochitona piceola	1	0	1	0	0	0	0	0
Lepidochitona simrothi	1	0	0	0	0	0	0	0
Acanthochitona fascicularis	1	1	1	1	1	1	0	0
% Shared species	100.0	40.0	80.0	60.0	60.0	60.0	40.0	20.0

Geographic distribution: from the Barents Sea down to Algarve (Portugal), the Mediterranean, the Azores (Flores), Madeira, Canary Islands, near Iceland, Greenland and the eastern coast of north America (KAAS & VAN BELLE, 1985a).

Family Ischnochitonidae

Callochiton septemvalvis **(Montagu, 1803)**

Callochiton achatinus (Brown, 1827). Urzelina bay, under stones (MORTON, 1967: 36).

Bathymetry: from subtidal to 500 m depth (KAAS & VAN BELLE, 1985b).

Dimensions: length = up to 22 mm; dorsal elevation = 0.35 to 0.46 (KAAS & VAN BELLE, 1985b).

Geographic distribution: all Atlantic coasts of Europe, from Scandinavia and British isles, south to the Canary Islands. Also in the Mediterranean Sea (KAAS & VAN BELLE, 1985b).

Lepidochitona piceola **(Shuttleworth, 1853)**

Lepidochitona piceola (Shuttleworth, 1853). São Miguel (intertidal zone) (KAAS & VAN BELLE, 1981: 23; 1985b: 89-91).

Dimensions: length = 10 mm; breadth = 6 mm; dorsal elevation = 0.31 (KAAS & VAN BELLE, 1985b).

Geographic distribution: Canary Islands and the Azores (KAAS & VAN BELLE, 1985b).

Lepidochitona simrothi **(Thiele, 1902)**

Lepidochitona simrothi (Thiele, 1902). Azores (VAN BELLE, 1984: 224-226). Flores, Faial, Terceira, Santa Maria and São Miguel (KAAS & VAN BELLE, 1981: 27-29; 1985b: 93-95). São Miguel (BULLOCK, 1995: 16). Azores (MORTON *et al.*, 1998: 57).

Lepidochitona sp. Azores (MACEDO *et al.*, 1998: 75).

Material examined: DBUA 190, 191, 193, 524, 554 and 562 – Flores (all intertidal zone); DBUA 337 – Formigas islets (intertidal zone); DBUA 457, 458, 459, 465, 475, 662 - Pico (0 to 3 m depth); DBUA 625, 715, 732, 740, 741, 743, 744, 745, 746, 747, 785, 793 – São Miguel (intertidal zone down to 14 m depth).

Bathymetry: littoral and sublittoral (up to 14 m depth).

Dimensions: length = 5-8 mm; breadth = 3-4 mm; dorsal elevation = 0.37.

Geographic distribution: endemic to the Azores (Pico, Faial, Flores, São Miguel and Formigas islets).

Remarks: specimens recorded by HAWKINS *et al.* (1990: 27-28) and AZEVEDO (1991: 29) probably belong to this species but were not identified at species level. These specimens were not present in the DBUA collection and could not be examined by us.

Family Acanthochitonidae

Acanthochitona discrepans **(Brown, 1827)**

Anisochiton discrepans Brown, 1827. Azores (MAC ANDREW, 1856: 145). São Miguel (DAUTZENBERG, 1889: 72).

Chiton discrepans (Brown, 1827). São Miguel (Ponta Delgada) (NOBRE, 1924: 84; 1930: 61).

Bathymetry: from the intertidal zone down to 40 m depth. It lives mainly on stones covered with algae in muddy zones (MACEDO *et al.*, 1999).

Dimensions: length = 25-30 mm (MACEDO *et al.*, 1999).

Geographic distribution: British isles, French Atlantic coast (KAAS, 1985) and the Azores (?).

Remarks: this is a dubious record. The specimens from Mac Andrew, Dautzenberg and Nobre are to be examined (STRACK, *in litt.*). So far, the occurrence of this species in the Azores remains highly questionable.

Acanthochitona fascicularis **(Linnaeus, 1767)**

Anisochiton fascicularis Linnaeus, 1766. Azores (MAC ANDREW, 1856: 145).

Acanthochites adansoni de Rochebrune, 1881. Faial (Horta, -20m) and Flores (Santa Cruz, -40m) (DAUTZENBERG, 1927: 232).

Acanthochitona communis (Risso, 1826). Azores (VAN BELLE, 1984: 227).

Acanthochitona fascicularis (Linnaeus, 1767). São Jorge (Urzelina bay) (MORTON, 1967: 36).

Material examined: DBUA 176, 637, 683, 700, 719, 721, 730, 731, 732, 733, 748, 751, 752, 767, 794 – São Miguel (intertidal zone down to 20 m depth); DBUA 240, 569, 574, 577, 799 – Flores (intertidal zone down to 20 m depth); DBUA 410, 433, 801 – Faial (10 m down to 23 m depth); DBUA 486, 667,

671, 726, 800 - Pico (intertidal zone down to 15 m depth).
Bathymetry: from the intertidal zone down to 50 m depth (VAN BELLE, 1984).
Dimensions: length = 26 mm; breadth = 16 mm.
Colour: extremely variable (black, olive, orange, whitish).
Geographic distribution: Brittany (France) and southern England to Madeira, Canary Islands, in the whole Mediterranean Sea (KAAS, 1985) and the Azores (Pico, Faial, São Jorge, Flores and São Miguel).

DISCUSSION

The publication of ÁVILA (2000) on the biogeographical relationships of the Azorean shallow-water marine molluscs did not include the Polyplacophora. That paper dealt with the Gastropoda, Bivalvia and Cephalopoda, of which 231 taxa were confirmed from the Azores. Adding now the 5 species of Polyplacophora reported from the Azores, the results are, as expected, very similar. The biogeographic region with higher number of shared species to the Azores is still the western Mediterranean (184 out of 236 or 78.0%), followed by Madeira (63.1%), the mainland of Portugal (62.3%) and the Canary Islands (59.7%). Only about 5% of the Azorean species occur at Ascension and Saint Helena islands, whereas there are 23 species that are also reported to the eastern coast of north America (Table 2).

These results corroborate those of ÁVILA (2000) who demonstrated a greater similarity of the Azorean malacofauna with the eastern Atlantic than with the western Atlantic, despite of the prevailing sea-surface currents from west to the east.

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Table 2: Number and percentage of shared species between the malacofauna of a given region and the Azores (236 confirmed taxa). ASC – Ascension Island; STH – Saint Helen Island; remaining abbreviations as in Table 1.

	AZO	% shared species
SCA	80	33.9
BRI	115	48.7
POR	147	62.3
MED	184	78.0
MAD	149	63.1
CAN	141	59.7
ASC	13	5.5
STH	12	5.1
AME	23	9.7

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